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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/706,156	11/12/2003	Tai-Chun Huang	TSM03-0340	7569

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EXAMINER	
OWENS, DOUGLAS W	
ART UNIT	**PAPER NUMBER**
2811	

DATE MAILED: 08/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/706,156	HUANG ET AL.	
	Examiner	Art Unit	
	Douglas W. Owens	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,6,8,9,13,16-19,21-24,27 and 29* is/are rejected.

7)☒ Claim(s) *3-5,7,10-12,14,15,20,25,26 and 28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 6, 8, 13, 16, 19, 21, 24, 27 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent Application Publication No. 2004/0251549 to Huang et al.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Regarding claim 1, Huang et al. teach a method of manufacturing an ILD layer of a semiconductor device (Fig. 1, for example), comprising:

forming a first low-dielectric constant material sub-layer (40) over the substrate, the first low-dielectric constant material having at least one first material property;

forming a second low-dielectric constant material sub-layer (58) over the first low-dielectric constant material sub-layer, the second low-dielectric constant material sub-layer having at least one second material property, wherein the at least one second material property is different from the at least one first material property paragraph [0020]; and

forming a third low-dielectric constant material sub-layer (82) over the second low-dielectric constant material sub-layer, the third low-dielectric constant material sub-layer having at least one third material property, the at least one third material property being different from the at least one second material property (paragraph [0021]).

Regarding claims 6 and 13, Huang et al. teach a method, wherein the first, second and third material property comprises dielectric constant.

Regarding claim 8, Huang et al. teach a method of manufacturing a semiconductor device, comprising:

providing a substrate (8), the substrate having component regions formed thereon;

forming a first etch stop layer (36) over the substrate;

forming a first ILD layer (40, 46, 44, 52, 54, 58, 60, 64, 66, 70, 78, 82) over the first etch stop layer; and

forming at least one first conductive region (38) in the first ILD layer and first etch stop layer, wherein at least one first conductive region make electrical contact with at least one component region of the substrate, and wherein forming the first ILD layer comprises:

forming a first low-dielectric constant material sub-layer (40) over the first etch stop layer;

forming a second low-dielectric constant material sub-layer (58) over the first low-dielectric constant material sub-layer, the second low-dielectric constant material sub-layer having at least one different material property than the first low-dielectric constant material sub-layer; and

forming a third low-dielectric constant material sub-layer (82) over the second low-dielectric constant material sub-layer, the third low-dielectric constant material sub-layer having at least one different material property than the second low-dielectric constant material sub-layer.

Regarding claims 16 and 21, Huang et al. teach an ILD layer of a semiconductor device, comprising;

a substrate (8) with component regions;

a first etch stop layer (36) disposed over the substrate;

a first ILD layer (40, 46, 44, 52, 54, 58, 60, 64, 66, 70, 78, 82) disposed over the first etch stop layer; and

at least one first conductive region (38) forming in the first ILD layer and first etch stop layer, wherein at least one first conductive region makes electrical contact with at least one component region of the substrate, and wherein the first ILD layer comprises:

a first low-dielectric constant material sub-layer (40), the first low-dielectric constant material sub-layer having at least one first material property;

a second low-dielectric constant material sub-layer (58) disposed over the first low-dielectric constant material sub-layer, the second low-dielectric constant material sub-layer having at least one second material property, wherein the at least one second material property is different from the at least one first material property; and

a third low-dielectric constant material sub-layer (82) disposed over the second low-dielectric constant material sub-layer, the third low-dielectric constant material sub-layer having at least one third material property, the at least one third material property being different from the at least one second material property.

Regarding claims 19 and 24, Huang et al. teach an ILD layer, wherein the first second and third material property comprises dielectric constant.

Regarding claim 27, Huang et al. inherently teach a semiconductor device, wherein the first low-dielectric constant material sub-layer comprises a first Young's modulus, wherein the first Young's modulus is greater than a second Young's modulus of the second low-dielectric constant material sub-layer and a third Young's modulus of the third low-dielectric constant material sub-layer, since the material is known to have a greater Young's modulus.

Regarding claim 29, Huang et al. teach a device, wherein the first low-dielectric constant material sub-layer is more adhesive than the second low-dielectric constant material sub-layer and the third low-dielectric constant material sub-layer.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 2, 9, 17, 18, 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al.

Regarding claims 2 and 9, Huang et al. teach a method, wherein the first and second low-dielectric constant material sub-layers comprise MSQ, an MSQ derivative, porogen/MSQ, an oxide MSQ, HSQ or a porogen HSQ (paragraph [0018]). Huang et al. further teach that the third low-dielectric constant material sub-layer may comprise "well known alternatives, having acceptably low k characteristics...". It would have been obvious to one of ordinary skill in the art to select one of the above listed materials, since they are well known and have low k characteristics. The selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Regarding claims 17, 18, 22 and 23 Huang et al. teach a device, wherein the first and second low-dielectric constant material sub-layers comprise MSQ, an MSQ derivative, porogen/MSQ, an oxide MSQ, HSQ or a porogen HSQ (paragraph [0018]). Huang et al. further teach that the third low-dielectric constant material sub-layer may comprise "well known alternatives, having acceptably low k characteristics...". It would have been obvious to one of ordinary skill in the art to select one of the above listed materials, since they are well known and have low k characteristics. The selection of a known material based on its suitability for its intended use supported a *prima facie*

obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

The product by process limitations in claims 18 and 23 have not been given any patentable weight. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Allowable Subject Matter

5. Claims 3 – 5, 7, 10, 11, 12, 14, 15, 20, 25, 26 and 28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

6. Applicant's arguments filed June 6, 2005 have been fully considered but they are not persuasive.

Applicant argues that Huang et al. do not disclose a method of forming "an inter-level dielectric (ILD) layer", which Examiner understands to mean that Huang et al. do not teach a method of forming a single ILD layer, comprising multiple sub-layers. There is nothing in the claims to limit the "an inter-level dielectric (ILD) layer" to a specific number of sub-layers. The sub-layers stacked from the substrate to the upper layer

(102) can be taken to be an inter-level dielectric (ILD) layer comprising multiple sub-layers, all of which are disposed over the substrate. The claims do not define the number of sub-layers permitted in the inter-level dielectric layer, nor are the boundaries of the ILD layer defined in the claims. The broad claim language permits multiple sub-layers in the ILD layer. The only boundary that can reasonably be assumed is that the sub-layers co-exist with the inter-level connections.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W. Owens whose telephone number is 571-272-1662. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven H. Loke can be reached on 571-272-1657. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Douglas W. Owens

Douglas W Owens
Examiner
Art Unit 2811

DWO